

US009411205B2

(12) United States Patent Kitajima et al.

(54) LIQUID CRYSTAL DISPLAY DEVICE AND MANUFACTURING METHOD THEREOF

(71) Applicant: Japan Display Inc., Tokyo (JP)

(72) Inventors: **Kenji Kitajima**, Oamishirasato (JP); **Ryouhei Suzuki**, Mobara (JP)

(73) Assignee: Japan Display Inc., Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35

U.S.C. 154(b) by 0 days.

This patent is subject to a terminal dis-

claimer.

(21) Appl. No.: 14/823,396

(22) Filed: Aug. 11, 2015

(65) Prior Publication Data

US 2015/0362807 A1 Dec. 17, 2015

Related U.S. Application Data

(63) Continuation of application No. 14/453,010, filed on Aug. 6, 2014, now Pat. No. 9,140,945, which is a continuation of application No. 13/437,037, filed on Apr. 2, 2012, now Pat. No. 8,810,746.

(30) Foreign Application Priority Data

Apr. 11, 2011 (JP) 2011-087713

(10) Patent No.:

US 9,411,205 B2

(45) **Date of Patent:**

*Aug. 9, 2016

(52) U.S. Cl.

CPC *G02F 1/136209* (2013.01); *G02F 1/1345* (2013.01); *G02F 1/13439* (2013.01); *G02F* 1/133512 (2013.01); *G02F 1/133514* (2013.01); *G02F 1/133528* (2013.01); *G02F 1/136286* (2013.01)

(58) Field of Classification Search

(56) References Cited

U.S. PATENT DOCUMENTS

6,750,937	B2*	6/2004	Karasawa G02F 1/1345 349/149
7,561,239	B2	7/2009	Fujita
7,595,854		9/2009	Sung et al.
2004/0135941	A1*	7/2004	Nam G02F 1/133512
			349/110
2005/0151920	A1	7/2005	Watanabe et al.
2008/0225221	A1	9/2008	Abe
2009/0268145	A1	10/2009	Anjo et al.

FOREIGN PATENT DOCUMENTS

$_{ m JP}$	H07-43706	Α	2/1995
JP	H09-113886	Α	5/1997
JP	2006-171386	A	6/2006
JP	2010-020209	Α	1/2010
	OTHER	PU	JBLICATIONS

Partial English translation of Office Action dated May 13, 2014 regarding a corresponding Japanese Patent Application No. 2011-087713.

* cited by examiner

Primary Examiner — Thanh-Nhan P Nguyen (74) Attorney, Agent, or Firm — Typha IP LLC

(57) ABSTRACT

A liquid crystal display device includes a thin film transistor substrate having a pixel region and a frame region, and a color filter substrate. The frame region includes a first metal wire that surrounds the outside of the pixel region, and a second metal wire that is formed so as to surround the outside of the first metal wire. The first metal wire has at least one slit at an area overlapping with a seal material.

15 Claims, 7 Drawing Sheets

